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Bouvier et al.

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(54) **SWITCH WITH LIGHT SUPPORTED IN OPERATING MEMBER**

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(51) **Int. Cl.**
H01H 9/18 (2006.01)

(52) **U.S. Cl.** **200/310**; 200/314

(58) **Field of Classification Search** 200/406, 200/516, 310, 314
See application file for complete search history.

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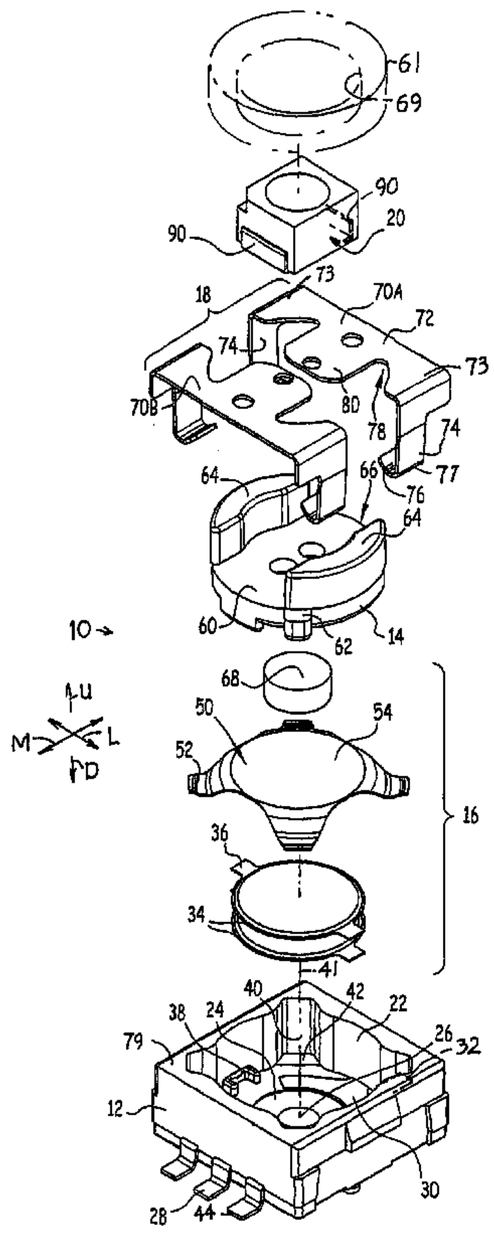
(57) **ABSTRACT**

A switching device includes a vertically moveable operating member (**14**) with a cavity (**66**) in which a light (**20**) lies. The light is supported on tongues (**80**) of a pair of sheet metal energizing members (**70**A, **70**B). Each energizing member has laterally opposite sides that form a pair of legs (**74**). The legs extend downward along opposite sides of the switch casing (**12**), and the legs have lugs (**76**) at their lower ends for soldering to traces on a circuit board.

5 Claims, 4 Drawing Sheets



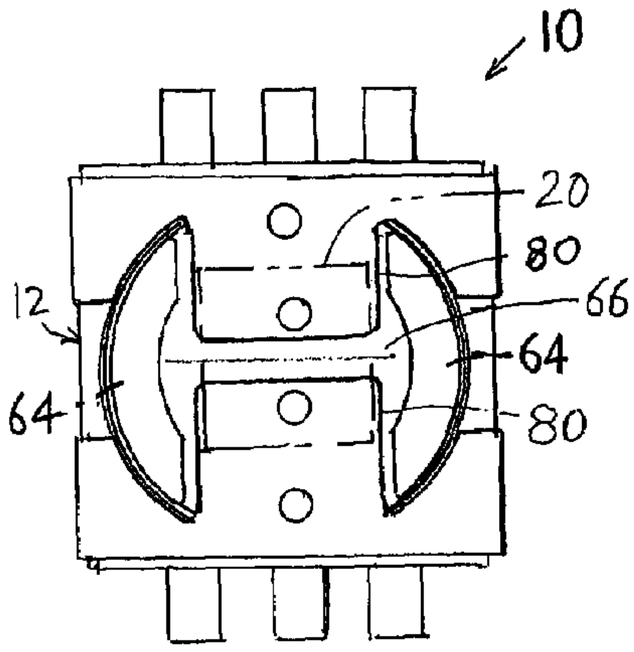
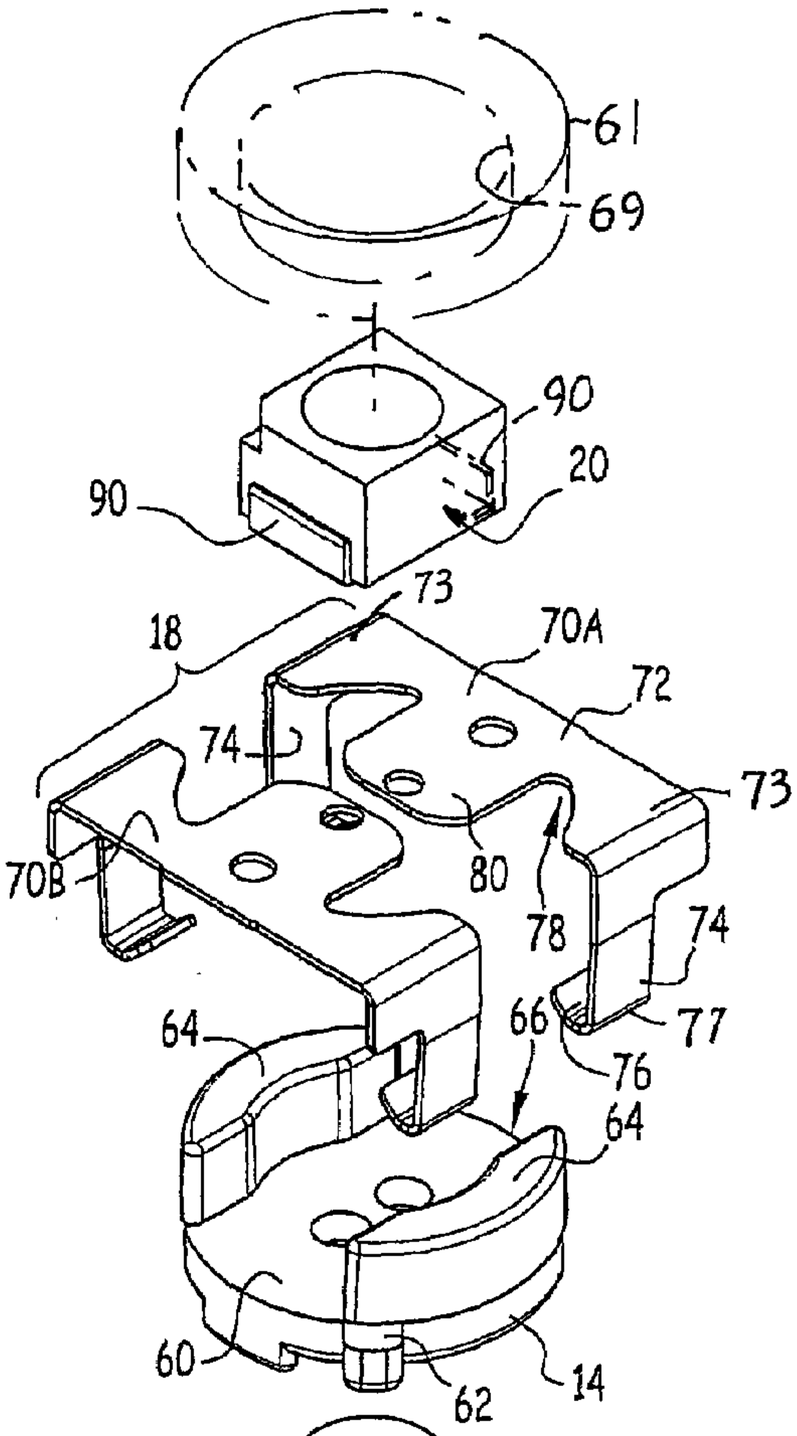
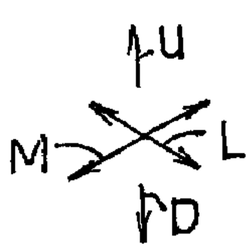


FIG. 1A





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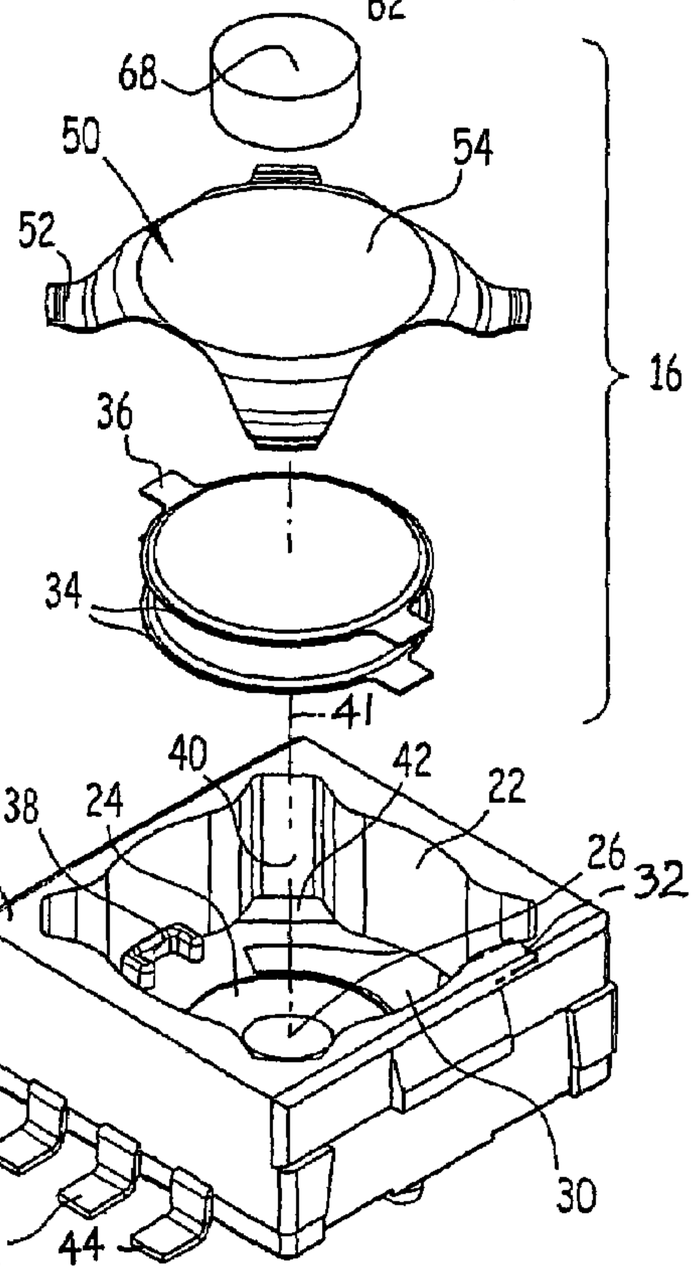


FIG. 1

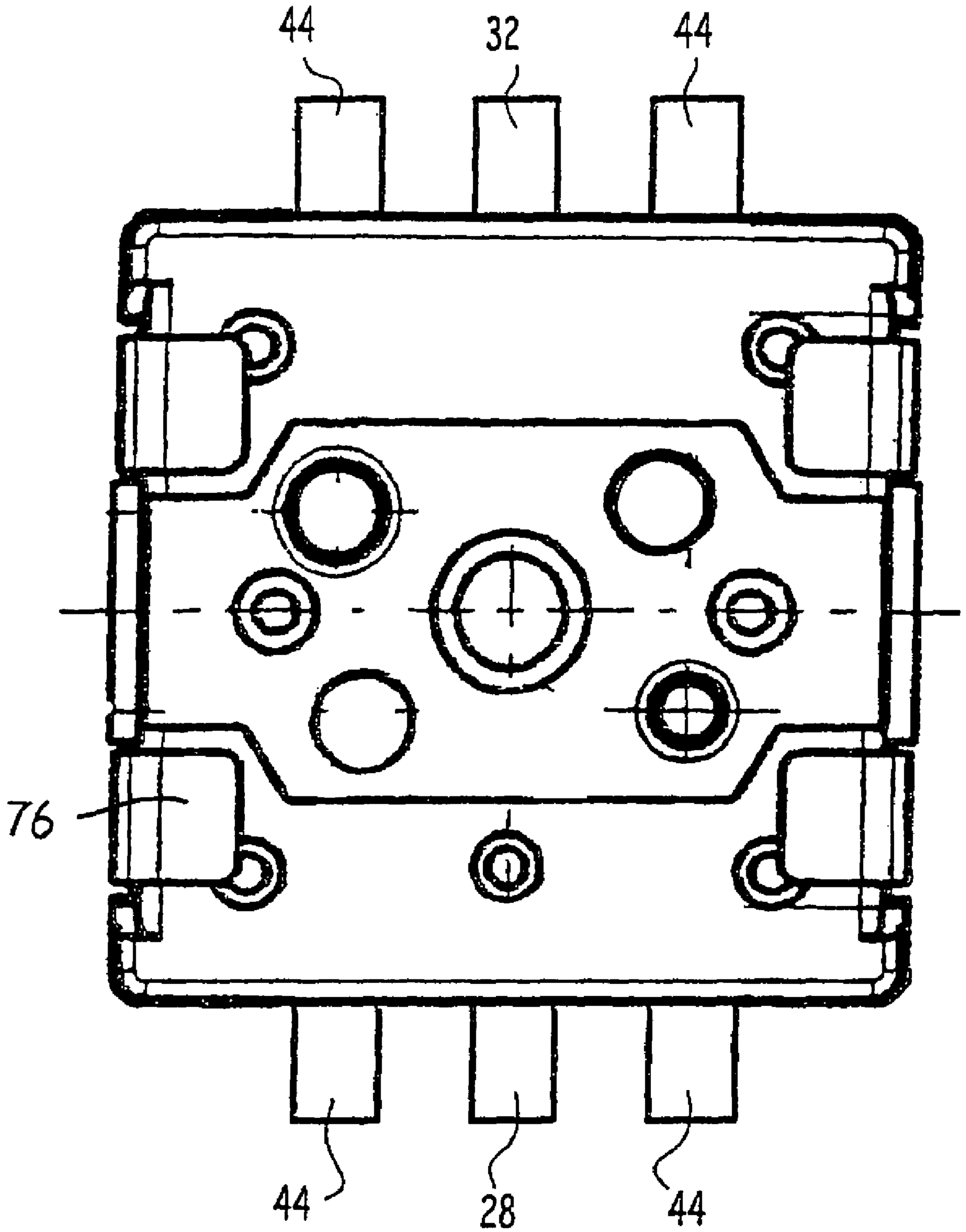
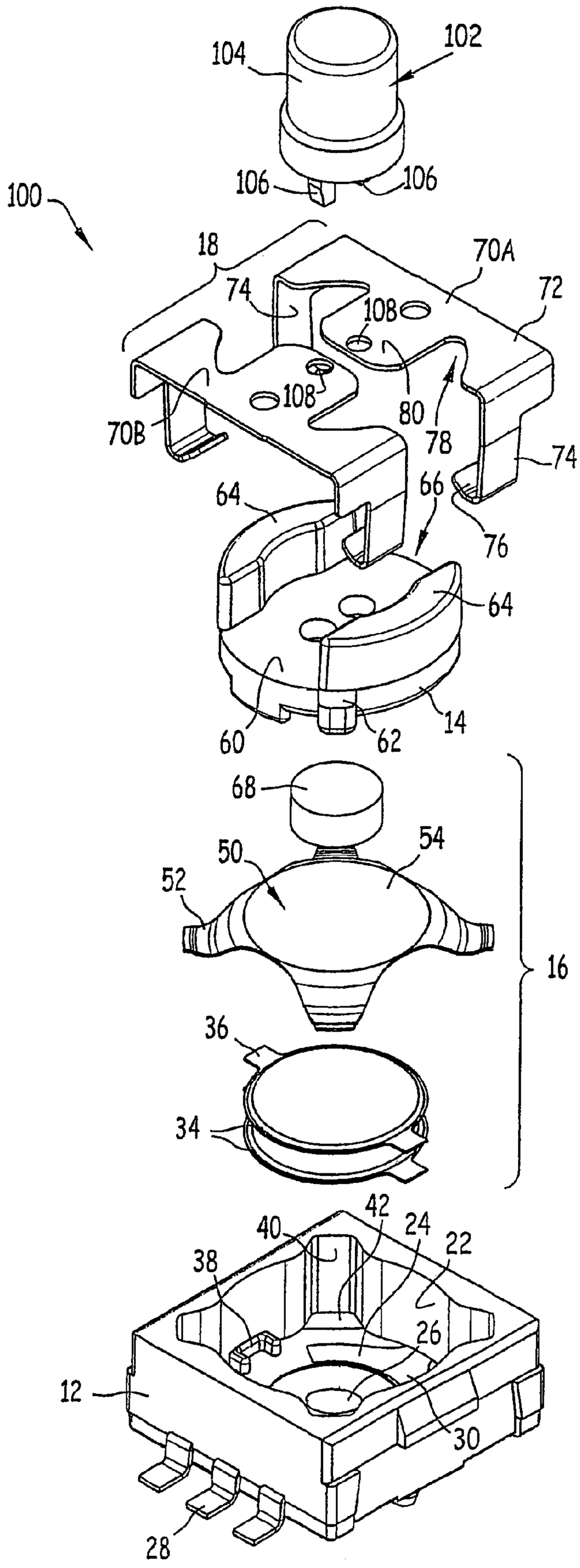


FIG.2


104
102
106
106
100
18
70A
74
72
108
108
80
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70B
74
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66
76
64
60
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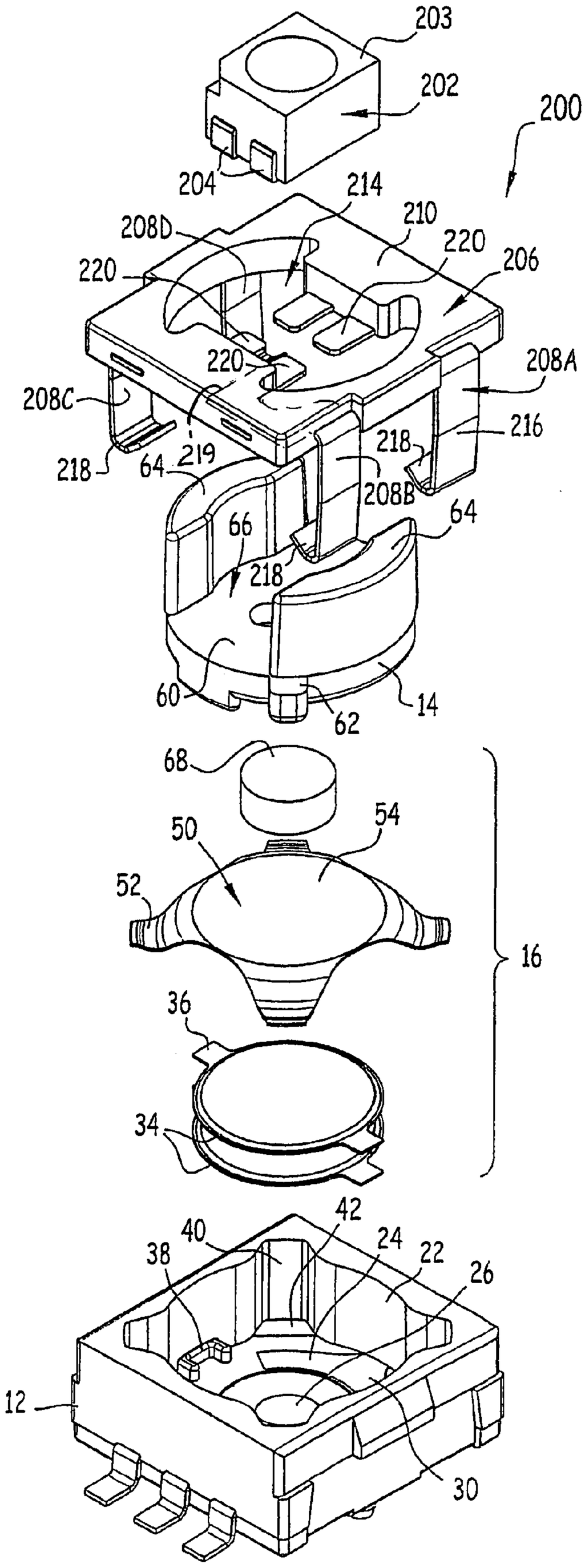
28

FIG.3


203
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208A
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64
218
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62
14
68
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50
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16
36
34
42
40
24
22
38
26
12
30

FIG.4

SWITCH WITH LIGHT SUPPORTED IN OPERATING MEMBER

CROSS-REFERENCE

Applicant claims priority from PCT Application PCT/IB2003/006085 filed 19 Dec. 2003 based on French patent application 03 00266 filed 10 Jan. 2003.

BACKGROUND OF THE INVENTION

It is known to integrate a light source in a commutation switch device so the light source lights the control button attached to the device. Such a switch device conventionally includes one or more resiliently deformable conductive strips which are displaced under the action of the operating member. Electrical connection terminals lie at the bottom of the switch device casing and allow connection to a printed circuit by soldering.

In order to be visible from the operating region, the light source must be arranged opposite the connection terminals and adjacent a push button. It is desirable but difficult for the electrical conductors which supply current to the light source from the connection terminals to extend through the switching mechanism, and this often leads to a larger switch device. As a result, switching devices which comprise a light source either have relatively large dimensions or are of complex design.

SUMMARY OF THE INVENTION

The invention provides a commutation, or switch device of reduced size which allows a light source, or light to be supplied with current in a switch device of simple and rugged design. The switch device includes at least two energizing conductors that have top parts that engage terminals of the light. The operating apparatus includes an operating member with a lower end that operates the switch mechanism and a transparent button lying over the operating member and under the light, and which is manually depressed. The operating apparatus has an upwardly-opening cavity and the light and tongues on the energizing conductors lie in the cavity. The energizing conductors are pieces of sheet metal that have legs that extend down to the bottom of the casing and that have lugs thereat that form solder terminals.

The invention will be better understood from a reading of the following description which is given purely by way of example with reference to the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an exploded isometric view of a switch device according to the invention.

FIG. **1**A is a plan view of the assembled switch device of FIG. **1**, with the push button and light removed.

FIG. **2** is a view from below of the switch device of FIG. **1** showing the connection terminals.

FIGS. **3** and **4** are exploded isometric views of variants of a switch device according to the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. **1** shows a commutation, or switch device **10** which includes a casing **12**, an operating member **14** which can move down D and up U relative to the casing and a

commutation, or switching mechanism **16** which lies in the casing **12** under the operating member **14**. The switch device further comprises a light source, or light **20** that includes a light-emitting diode, and an energizing arrangement **18** that supplies current to the light. A transparent push-button **61** is attached to the operating member **14** and lies above the light **20**. This arrangement improves visual appearance and facilitates operation when the switching device is installed in an electronic piece of equipment such as a motor vehicle dashboard console.

The casing **12** is generally of parallelepipedal form. It is constructed from insulating plastic material. It forms a generally cylindrical cavity **22** which is closed at its lower end by a base **24**. A center conductor **26** on the base is connected to a connection terminal **28** which protrudes from the base. An annular conductor **30** which lies around the center conductor is connected to a connection terminal **32** (FIG. **2**) which protrudes from the base.

The switching mechanism **16** comprises two resilient conductive discs **34** which rest against the annular conductor **30**. At rest, these discs **34** are spaced from the central conductor **26**. The discs **34** have diametrically opposed positioning tabs **36**. The casing **12** has notches **38** for receiving the tabs to fix the rotational positions of the discs **34**.

The generally cylindrical surface **22** of the casing cavity is interrupted by four cut-outs **40** which are spaced at 90° about the vertical axis **41** of the device. The cut-outs **40** extend along radial lines into the cylindrical wall. A conductive region **42** lies at the bottom of each cut-out **40**. Each conductive region **42** is connected to a connection terminal **44** which protrudes from the base of the casing.

The switching mechanism **16** comprises a resilient conductive bell **50** with four radially extending arms **52**. The arms are angularly spaced at 90° and the free ends of the arms are received in the cut-outs **40** and rest on the four conductive regions **42**. The arms **52** are downwardly deformed so in the rest position, the central region **54** of the bell lies higher than the ends of the arms that rest on the conductive regions **42**. In particular, at rest the central region **54** is spaced from the conductive discs **34**.

The operating member **14** is generally of cylindrical shape, with a circular base **60** having four radial projections **62** are angularly spaced by 90° to each other. The projections lie in the cut-outs **40** which guide the operating member in up and down movement. The operating member **14** has two diametrically opposed and laterally L spaced upward protuberances **64**, which protrude above the upper surface of the base **60**. The two protuberances together form a free space, or empty region, or operating member cavity **66** for receiving the light **20**. A transparent push button **61** with a bottom recess **69** is mounted on the protuberances.

A spacer **68** which is formed from a resiliently compressible material is interposed between the central region of the bell **50** and the operating member **14**. As illustrated in FIG. **1**, the discs **34**, the bell **50**, the spacer **68** and the operating member **14** are stacked in this order from the base **24** of the casing.

In accordance with the present invention, the energizing arrangement **18** includes two sheet metal energizing conductors **70**A, **70**B that support the light **20** in or over the operating member cavity **66** and that carry current to the light to energize it. The energizing conductors partially surround the casing and close much of the open upper end of the casing cavity **22**. The energizing conductors are generally U-shaped and are fixed to the casing **12** at legs **74** of the U-shape.

The two sheet metal energizing conductors **70**A, **70**B are longitudinally (M) spaced and are symmetrical relative to a lateral plane. Each energizing conductor has a top part **72** with laterally opposite sides **73** connected by a right angle bend to a pair of vertical legs **74**. A lug **76** is formed at the lower end of each leg by a right angle bend **77**. The lugs **76** of the same energizing conductor are bent to extend toward one another and are bent to lie under the bottom of the base **24** of the casing. The legs **74** extend down along the outside of the casing. The lugs are designed to be soldered to traces on a circuit board together with the other terminals **28**, **32**, **44**. The top parts **72** lie against the top **79** of the casing and the top parts engage the operating member base **60** when the operating member is not depressed.

The top parts of the energizing conductors are longitudinally M spaced. They have cut-outs **78** and the protuberances **64** of the operating member extend through the cutouts. The energizing conductors form tongues **80** which support and connect to the light source **20**. The tongues **80** further form a retaining stop that limits upward movement of the operating member. The tongues **80** extend into the operating member cavity **66** that lies between the two protuberances. Each energizing conductor **70**A, **70**B is formed from a single piece of sheet metal which has been cut and shaped as by stamping.

In the embodiment of FIGS. **1**, **1**A and **2**, the light source **20** includes a single light-emitting diode of the SMC type (Surface Mounted Component). The diode has a lower face and two terminals **90** which allow the diode to be mounted on a surface. The two terminals have coplanar flat surfaces. They allow surface connection, for example, by soldering the diode to the tongues **80** of the top parts **72** of the two energizing conductors. The light **20** is received in the cavity, or space **66** of the operating member **14**, between the two protuberances **64** which protrude through the cut-outs **78**.

When the operating member **14** is depressed, two contacts are successively connected. For the case of slight depression of the operating member **14**, the bell **50** is resiliently deformed until it comes into contact with the domes **34**. A connection is then made between the four terminals **44** that lead to the conductive regions **42** and the terminal **32** that leads to the conductive surface **30**. For the case of greater depression of the operating member **14**, the conductive discs **34** are deformed until they come into contact with the conductive region **26** on the casing base, thereby connecting the four terminals **44** and the terminals **28** (which connects to region **26**) and **32**. When the operating member is released, it once more takes up the rest position under the resilient action of the discs **34** and the bell **50**.

The energizing conductors limit upward movement of the operating member **14**, hold the light under the transparent push button **67**, help close the top of the casing cavity, and provide current to the light, in a compact switch device. The lugs **76** which lie against the bottom surface of the casing **12** form connection terminals while ensuring the mechanical retention of the two energizing conductors to the casing **12**.

FIGS. **3** and **4** illustrate two variants of the switch device. In these Figures, elements identical or similar to those in the preceding Figures are identified using the same reference numerals.

The switch device **100** of FIG. **3** differs only in that the light source **102** includes a light emitting diode overlaid by a generally cylindrical translucent member **104** having two conductive tabs or rods **106**. The tabs protrude downward beyond an end disc. The tabs project into openings **108** in the tongues **80** and are soldered thereto.

FIG. **4** shows a switch device **200** with a light **202** which includes two light-emitting diodes that are overmolded by the same transparent body **203**. The light source has four connection terminals **204** which protrudes at the lower face. It would be possible to energize the two diodes in parallel using only three terminals.

In this embodiment, the energizing arrangement **206** for carrying current to the light source includes four separate energizing conductors **208**A, **208**B, **208**C, **208**D. These separate energizing conductors are connected mechanically to each other by an insulating frame **210** which is overmolded to portions of the top parts of the energizing conductors. The four energizing conductors each has a leg **216** with a lug **218** at its lower end which can engage the bottom surface of the base **24** of the casing and form a connection terminal. The top parts **219** of the energizing conductors have exposed tongues **220** that lie in the open space **66**. The tongues connect to the four terminals of the light and support the light. The insulative frame **210** defines internal passages through which the protuberances **64** of the operating member extend and move slightly up and down.

Although terms such as "top", "bottom", etc. have been used to describe the invention as it is illustrated, it should be understood that the switch device can be used in any orientation.

The novel features of the invention are set forth with particularity in the appended claims. The invention will be best understood from the following description when read in conjunction with the accompanying drawings.

What is claimed is:

1. A switching device of a type that has a casing with an upwardly opening casing cavity, a switching mechanism lying in said casing, an operating member that is moveable to operate said switching mechanism, a light lying above at least part of said operating member and having a pair of light terminals, and at least two energizing conductors mounted on said casing for carrying electricity to said light, wherein:

said energizing conductors each has a top part that lies above a part of said operating member and that engages one of said light terminals, each energizing conductor having a leg that extends downwardly to the bottom of said casing, and each energizing conductor having a lug that lies at the bottom of its leg and that forms a terminal;

said operating member has an operator base and a pair of laterally spaced protuberances projecting upward from laterally opposite sides of said base and leaving an operator cavity between said protuberances;

said energizing conductors are each formed of a piece of sheet metal, the top part of each of said energizing conductors having side portions lying at longitudinally opposite sides of said operating member and said top parts having tongues projecting towards each other into said operator cavity, said side portions each extending laterally to a top of one of said legs.

2. The switching device described in claim **1** wherein said light has at least three terminals and said energizing conductors comprises at least three sheet metal energizing conductors, and wherein:

first and second of said energizing conductors have longitudinal side parts that lie on the same longitudinal side of said operating member and have first and second tongues that are laterally spaced and that each projects into said base cavity portion, said first and second energizing member top parts of said first and second energizing members extend laterally away from each other and each is joined by a right angle bend to

one of said legs, each leg having a lower end joined to one of said lugs that extends under said base.

3. A switching device of a type that has a casing with an upwardly opening casing cavity, a switching mechanism lying in said casing, an operating apparatus that is depressable to operate said switching mechanism, a light having at least first and second light terminals, and at least first and second energizing conductors for carrying electricity to said light, wherein:

said operating apparatus has a depressable button and an operating member that is depressed by said button and that operates said switching mechanism when said button is depressed, and said operating apparatus forms an empty region under said button and above at least part of said operating member;

said first and second energizing conductors are each formed of sheet metal, are each fixed to said casing, each has a top part with a tongue that projects into said empty region, and each has a leg that extends downward from the top part of the energizing conductor with each leg having a lug at its bottom that forms a terminal lying at the level of the bottom of said casing;

said light lies in said empty region and said light terminals are each joined to a different one of said tongues;

said first and second energizing conductors have laterally opposite side portion that lie beyond opposite sides of said operating apparatus and that each connects one of said tongues to one of said legs.

4. A switching device of a type that has a casing with an upwardly opening casing cavity, a switching mechanism lying in said casing, an operating apparatus that is depressable to operate said switching mechanism, a light having at least first and second light terminals, and at least first and second energizing conductors for carrying electricity to said light, wherein:

said operating apparatus has a depressable button and an operating member that is depressed by said button and that operates said switching mechanism when said button is depressed, and said operating apparatus forms an empty region under said button and above at least part of said operating member;

said first and second energizing conductors are each formed of sheet metal, are each fixed to said casing, and each has a top part with a tongue that projects into said empty region, said energizing conductors forming legs that lie outside the casing with the legs having lugs that extend under the casing to fix the energizing conductors to the casing;

said light lies in said empty region and said light terminals are each joined to a different one of said tongues.

5. A switching device of a type that has a casing with an upwardly opening casing cavity, a switching mechanism lying in said casing, an operating apparatus that is depressable to operate said switching mechanism, a light having at least first and second light terminals, and at least first and second energizing conductors for carrying electricity to said light, wherein:

said operating apparatus has a depressable button and an operating member (**14**) that is depressed by said button and that operates said switching mechanism when said button is depressed, said operating member has a base (**60**) that lies under said button and above at least part of said switching mechanism with said operating member also having a pair of laterally (L) spaced upward projections (**64**) that extend up from said base and that form a cavity (**66**) between said projection and above the base, that has cavity longitudinally (M) open ends;

said first and second energizing conductors are each formed of sheet metal, are each fixed to said casing, each has a top part with a tongue (**80**) that projects longitudinally (M) into said cavity through said cavity open end, and each that lies closely above said base when the operating apparatus is not depressed;

said light lies in said cavity and said light terminals are each joined to a different one of said tongues in solder joints that lie in said cavity.

* * * * *